The foregoing evidence on the Limpkin's utilization of *Viviparus* raises the question whether this bird, as well as aboriginal man, may not have played a part in the gradual building up of the vast shell mounds along the St. John's. A point remaining to be investigated, however, is whether or not the Limpkin breaks the shell of *Viviparus* in order to secure the fleshy parts. A very large proportion of these shells in the mounds along the St. John's appear to be more or less intact. It does not break the shell of *Pomacea*.

Mr. Francis M. Weston (*in litt.*, May 8, 1938) calls my attention to the fact that in my previous paper (1936b, p. 39) Spring Creek was erroneously placed west, instead of east, of Marianna, Fla. He adds: "You might be interested to know that the Limpkin not only occurs but also nests in the upper reaches of that creek. I have also found the Limpkin nesting some miles west of Marianna, at least nine miles west of Spring Creek. . . . There seems to be no good reason why Pomacea and the Limpkin should not be found in the S. E. corner of Alabama and the S. W. corner of Georgia."

Hitherto the western limit of the Limpkin's known breeding range has been Wakulla County, Florida.

Literature Cited

Bryant, Henry. 1859. [Birds of East Florida.] Proc. Boston Soc. Nat. Hist., vol. 7, pp. 5–21.

Cottam, Clarence. 1936. Food of the Limpkin. Wilson Bull., vol. 48, pp. 11–13.

Harper, Francis. 1936a. The distribution of the Limpkin and its staple food. The Oriole, vol. 1, pp. 21–23, 1 fig., 1 map.

Harper, Francis. 1936b. The distribution of the Limpkin and its staple food, *Pomacea*. The Nautilus, vol. 50, pp. 37–40, 1 fig., 1 map. (A revised reprint of the preceding paper.)

THE LAND MOLLUSCA OF COOSA COUNTY, ALABAMA

By Allan F. Archer

Coosa County, Alabama, lies in the east central portion of the state. It is of particular interest in possessing a characteristic Piedmont fauna, at least insofar as the lower section of the Pied-

mont is concerned. The data presented are the result of ecological and biological studies carried on under the auspices of the Department of Conservation of the State of Alabama. Some of the most significant collections were made during the expedition of June, 1940, under the auspices of the Department of Conservation and the Alabama Museum of Natural History. Several other important visits to the county have been made by me.

H. H. Smith made excellent collections of Mollusca in Chambers and Randolph Counties. The latter county resembles Coosa County in topography but is slightly less irregular in surface. Coosa County surpasses all Piedmont counties in Alabama in the variety of topography, and is therefore richest in suitable collecting spots. Not merely is the Piedmont represented over most of the county, but there is a minor representation of the Blue Ridge Province in the northwestern corner. There we find the Talladega Mountains. Their snail fauna is rather indifferent, although there are some special botanical features of interest. In the southwestern corner of the county are a few square miles of Coastal Plain country.

The Talladega Mountains present a more or less mature topography. Otherwise Coosa County is characterized by irregular uplands, almost mountainous in spots, ravines, valley slopes, and flat valleys. The ravines present a juvenile aspect, and at Hatchet Creek three obscure ravines have waterfalls. The soils of the county are reddish or gray sand-clay materials quite lacking in lime, but on the slopes at least fairly well mineralized. The poorest molluscan localities are found where mica schist outcrops. A considerable proportion of the county is underlain by mica schist (Ashland), granite (Pinckneyville), and quartzite. Basic and acidic intrusive rocks are present. Chlorite schist, slate, and dolomite occur in the northwestern corner. It is thus obvious that we are dealing with an ancient continental area having a predominance of crystalline and metamorphic rocks.

Woodland covers a considerable portion of the country, being least in evidence on cultivated uplands and flat valleys. Upland areas have as their forest cover oak-pine communities (shortleaf pine, blackjack oak). Pine and oak-pine cover also occur on slopes, especially on spurs of interfluves, but more species of

pines, oaks, and various hardwood species of lesser importance are present. Beech, black, white, and Spanish oak occur even in top ravines. Typical ravines of the Piedmont area are characterized by the following woody plants: *Pinus echinata, Quercus alba, Q. borealis maxima, Q. velutina, Hicoria alba, Fagus grandifolia, Magnolia macrophylla, Liriodendron tulipifera, Aralia spinosa, Cercis canadensis, Cornus florida, Hamamelis virginiana, Nyssa sylvatica.* The chestnut oak (*Q. montana*) also occurs in the Talladega Mountains. Species of the lower story include *Ilicium floridanum, Euonymus americanus, Hydrangea quercifolia, H. arborescens, Azalea nudiflora, Rhododendron punctatum, Kalmia latifolia, Halesia diptera.* By way of contrast between subtropical and montane floras there is present in one locality of the Talladega Mountains *Galax aphylla* in company with the palm, *Serenoa serrulata.*

Wherever there has been sufficient recovery from fires an adequate leaf litter, humus, and topsoil are formed. In the Talladega Mountains many acres of timber lack the layer of humus between the leaf litter and soil (due to recent fires). In the Piedmont area, with few exceptions, conditions are much better. The hydrogen ion concentration of the humus and topsoil ranges from about 5.0 to a little above 6.0. The lower pH values occur at the bottoms of ravine slopes close to water wherever growths of laurel, rhododendron, and azalea prevail. Lower values likewise may occur in impoverished soils of the uplands. The higher pH values appear on the middle and upper zones of stream-valley slopes and ravines (of the lower series). Even here the humus is predominantly mouldy except in patches actively worked-over by soil arthropods, or under concentrations of twigs, limbs, bark, and hardwood logs, as well as where stones and rocks are numerous. Some slopes are entirely rocky, although there is no real talus formation. In general the richest humus occurs in those zones where conditions of dryness or partial dryness prevail.

The lack of calcium carbonate is undoubtedly one factor in determining the rather acidic qualities of Piedmont soils. Another immediate factor is the acid break-down of oak leaves and pine straw. A. E. Boycott (The Habitats of Land Mollusca in Britain, Journ. Ecology, 1934, Vol. 22, pp. 11–12) states that

shelter and lime are complementary factors which interact with climate. He further states that damp acid woods may have quite a respectable fauna. This is in part true of the Piedmont, although in Alabama and Georgia the zones in acid woods which dry out during dry spells have a richer fauna than do the perpetually damp zones. Boycott also states that humus samples from acid woods are not as rich either in Mollusca or Arthropoda as are samples from calcareous woods. To a large extent this is true in Coosa County. A large series of humus samples fail to yield expected snails like *Punctum minutissimum*, but instead yield Retinellae and *Zonitoides arboreus*. However, erigonine and theridiid spiders are quite as abundant in humus samples from Hatchet Creek as from calcareous localities. Likewise false scorpions, Phalandidae (*Libitiodes sayi*), as well as beetles of the families Carabidae, Pselaphidae, and Histeridae are reasonably common in leaf litter as well as under wood.

Aside from the minutiae the larger mollusks are fairly common. In fact Coosa County comes next to ranking with the best of the Piedmont counties in Alabama and Georgia. However, H. H. Smith collected a phenomenal series of minutiae at Roanoke in Randolph County, actually a total of 35 authentic species excluding the slugs. For the entire county there are approximately 39 or 40 species known. The soil of the county must contain more lime than is to be found in Coosa County, although the rock formations are Archaean igneous gneiss and schist. Randolph exceeds all known Piedmont counties of Georgia. Coosa County, however, is hardly surpassed by any other Alabama counties in some Arthropoda (which certainly do not depend on lime). The ample nature of the spider fauna is illustrated by the fact that the family Argiopidae, already fully catalogued, comprises 36 species.

The list given below is briefly annotated:

1. *Philomycus carolinianus* (Bosc.). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek; Hanover; Talladega Mountains.

2. *Deroceras laeve gracile* Rafinesque. Swamp Creek.

3. *Haplotrema concavum* (Say). Swamp Creek; Hatchet Creek. Rather common under ripe logs and in hollows under rocks.

4. *Anguispira alternata crassa* 'Clapp' Walker. Not common. Nearly as often in piles of rocks as under logs or bark.

5. *Discus patulus* (Deshayes). Hatchet Creek. Although occasionally under rocks it is locally abundant in association with logs and bark.

6. *Helicodiscus parallelus* (Say). Swamp Creek; Hatchet Creek. Under rocks or in leaf litter.

7. *Euconulus chersinus* (Say). Swamp Creek; Hatchet Creek; Talladega Mountains. In leaf litter.

8. *Retinella indentata paucilirata* (Morelet). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek. This species bears a suspicious resemblance to *R. carolinensis*, but anatomical material collected in winter will be needed to prove its identity. Generally in leaf litter, under bark, or rocks.

9. *Retinella sculptilis* (Bland). Hatchet Creek. Smaller than the form in North Carolina.

10. *Mesomphix perlaevis* Pilsbry. Swamp Creek; Hatchet Creek. Generally buried in humus.

11. *Mesomphix pilsbryi* (Clapp). Five mi. so. of Rockford; Hanover; Talladega Mountains. Occasionally under logs.

12. *Hawaiia minuscula* (A. Binney). Rockford; Hatchet Creek.

13. *Striatura meridionalis* (Pilsbry and Ferriss). Hatchet Creek. In leaf litter.

14. *Gastrodonta interna* (Say). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek; Hanover; Talladega Mountains. Common under loose bark on logs; also under rocks. One of the most abundant species; over 100 have been taken.

15. *Zonitoides demissus* (A. Binney). Swamp Creek; Hatchet Creek.

16. *Zonitoides intertextus* (A. Binney). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek; Hanover; Talladega Mountains. On slopes and uplands.

17. *Zonitoides arboreus* (Say). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek; Talladega Mountains.

18. *Polygyra pustuloides* (Bland). Hatchet Creek. Under rocks on rich, dry slopes.

19. *Stenotrema barbigerum* (Redfield). Swamp Creek;

Hatchet Creek; Talladega Mountains. Widely scattered under fallen bark, ripe logs, and in rock piles. Only 29 specimens have been taken.

20. *Stenotrema stenotrema* (Pfeiffer). Hatchet Creek; Talladega Mountains. On the under surfaces of rocks in rock piles; also under logs and bark. It occurs from the bases of ravines and slopes up to the summits. At Hatchet Creek it is the most abundant *Stenotrema*. Sixty-one specimens have been collected.

21. *Stenotrema maxillatum* (Gould). Swamp Creek; Hatchet Creek. This snail occurs on the middle and upper zones of the lower series of side ravines, often in rather open cover, very dry in late summer. It is generally found on the under surfaces of angular rocks, either scattered rocks or rock piles. At least 66 specimens have been collected in both localities.

22. *Mesodon inflectus* (Say). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek; Hanover; Talladega Mountains. In rock piles and under ripe logs. At Hatchet Creek there is a very large race whose greater diameter exceeds 13 mm.

23. *Mesodon perigraptus* (Pilsbry). Five mi. so. of Rockford; Swamp Creek; Hatchet Creek; Hanover; Talladega Mountains.

24. *Mesodon thyroidus* (Say). Swamp Creek; Hatchet Creek; Talladega Mountains.

25. *Triodopsis tridentata* (Say). Hatchet Creek. Usually under rocks but also under ripe logs and fallen bark, both in hardwood and pine areas. The most common species of the genus. Thirty-one specimens have been collected.

26. *Triodopsis fallax vannostrandi* (Bland). Five mi. so. of Rockford; Swamp Creek. According to Pilsbry's new manual this species is to be known as *T. vannostrandi alabamensis* (Pilsbry). Under logs, rocks, and in plant debris. Not as common as *tridentata* but pretty generally distributed in some ravines and in open fields.

27. *Triodopsis caroliniensis* (Lea). Hatchet Creek. In rock piles. Uncommon.

28. *Triodopsis albolabris major* (A. Binney). Hatchet Creek.

29. *Gastrocopta pentodon* (Say). Hatchet Creek. Found mostly in arthropod dung at the bases of large rocks.

30. *Strobilops labyrinthica* (Say). Swamp Creek; Talladega Mountains. Under beach logs.

31. *Strobilops aenea* Pilsbry. Hatchet Creek. Under ripe logs on rocky ground. Careful search failed to find this species under loose bark on logs (its customary habitat) although plenty of *Discus, Gastrodonta*, and *Zonitoides arboreus* were present.

COLOR VARIATION IN *OLIVELLA BIPLICATA*

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The following remarks are based upon a series of 2757 specimens of *Olivella biplicata* collected alive at Bolinas, Marin County, California, November 12 and December 12, 1940, and January 26, 1941. Of this series 94 are very young, the largest being only 12 mm. long, the smallest 7 mm. long.

Of the 2757, all but one (a xanthochroistic specimen) have varying amounts of bishop purple color (Maerz and Paul,[1] plate 44, H 10) about the aperture, especially near the base of the columella. Another division of the 2757 may be made on the basis of presence or absence of orange coloring within the aperture. 299 have varying amounts of orange, 2458 (including the 94 very young shells) lack it.

Normal external color in adults varies from pearl gray and moonbeam gray (Maerz and Paul, plate 44, A 1 and A 2) to grayish brown and brownish suffused with purple. The brownest individual matches more or less Maerz and Paul's blue fox color (plate 47, E 1). The darkest individual (not quite adult) matches approximately Maerz and Paul's plate 48, E 1 which is a grayish brown. The parietal callus is white or whitish in all. Many have a wash of "horn" color on the body whorl. This is true even of some of the albinos, which appear ivory in color (Maerz and Paul, plate 10, B 2). This "horn" color is ephemeral and disappears in beach-worn specimens.

All have bishop purple at base of columella and in the aperture except the xanthochroistic one mentioned. All normally colored

[1] A. Maerz and M. Rea Paul, A Dictionary of Color. First Edition. McGraw-Hill Book Co., Inc., New York. 1930.